

THAT WHICH IS CLAIMED:

1. A system for acoustic detection of blowout precursors comprising:
a combustor;
5 a pressure measuring device in communication with the combustor, wherein
the pressure measuring device generates pressure signals indicative of the pressure in
the combustor; and
a blowout precursor detection unit that receives the pressure signals and
performs at least one of a spectral analysis, statistical analysis, and wavelet analysis
10 to identify a blowout precursor.
2. The system as in claim 1, further comprising a combustion controller that
controls operation of the combustor based at least in part on detection of a blowout
precursor by the blowout precursor detection unit.
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3. A method for detecting blowout precursors in combustors comprising:
receiving pressure data measured by an acoustic pressure device associated
with the combustor;
performing spectral analysis on the pressure data using Fourier transform
20 analysis;
performing statistical analysis on the pressure data using statistical moments;
performing wavelet analysis on the pressure data using wavelet transform
analysis; and
determining the existence of a blowout precursor based on one or more of the
25 spectral analysis, statistical analysis, and wavelet analysis.
4. A method for detecting blowout precursors in combustors comprising:
receiving pressure data measured by an acoustic pressure device associated
with a combustor;

performing spectral analysis on the pressure data using Fourier transform analysis; and

determining the existence of a blowout precursor based on the spectral analysis.

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5. The method of claim 4, wherein performing spectral analysis comprises:

determining a Fourier transform of at least part of the pressure data; and

10 determining a power ratio of power in a frequency range normalized by total spectral power.

6. The method of claim 5, wherein determining the existence of a blowout precursor comprises determining the existence of a blowout precursor based on a predefined change in the power ratio.

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7. The method of claim 4, wherein performing spectral analysis comprises:

determining a Fourier transform of at least part of the pressure data; and

20 determining a power ratio of power at a specific frequency normalized by total spectral power.

8. The method of claim 7, wherein determining the existence of a blowout precursor comprises determining the existence of a blowout precursor based on a predefined change in the power ratio.

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9. A method for determining blowout precursors in combustors, comprising:

receiving pressure data measured by an acoustic pressure of a combustor;

performing statistical analysis on the pressure data using statistical moments;
and
determining the existence of a blowout precursor based on the statistical
analysis.

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10. The method of claim 9, wherein performing statistical analysis
comprises:

determining a statistical moment of at least part of the pressure data.

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11. The method of claim 10, wherein determining the existence of a
blowout precursor comprises determining the existence of a blowout precursor based
on a predefined change in a magnitude of the statistical moment.

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12. The method of claim 9, wherein performing statistical analysis
comprises:

determining a statistical moment of at least part of the pressure data; and
determining the variance of the statistical moment.

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13. The method of claim 12, wherein determining the existence of a
blowout precursor comprises determining the existence of a blowout precursor based
on a predefined change in the variance of the statistical moment.

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14. The method of claim 9, wherein performing statistical analysis
comprises:

determining a statistical moment of at least part of the pressure data;
dividing the statistical moment pressure data into a plurality of time
segments; and
defining a statistical moment threshold.

15. The method of claim 14, wherein determining the existence of a blowout precursor comprises determining the existence of a blowout precursor based on a number of instances in a given time segment that the statistical moment exceeds the statistical moment threshold.

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16. The method of claim 14, wherein determining the existence of a blowout precursor comprises determining the existence of a blowout precursor based on a total time in a given time segment that the statistical moment exceeds the statistical moment threshold.

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17. The method of claim 9, further comprising filtering the pressure data with a bandpass filter.

18. A method for determining blowout precursors in combustors,
15 comprising:
receiving pressure data measured by an acoustic pressure device associated with the combustor;
performing wavelet analysis on the pressure data; and
determining the existence of a blowout precursor from the results of the
20 wavelet analysis.

19. The method of claim 18, wherein performing wavelet analysis comprises:
determining a wavelet transform of at least part of the pressure data;
25 defining a root mean square of wavelet transform threshold; and
determining a ratio of the root mean square of the wavelet transform of the pressure data to the root mean square of pressure data.

20. The method of claim 19, wherein determining the existence of a blowout precursor comprises determining the existence of a blowout precursor based on a predefined change in the ratio.

5 21. The method of claim 18, wherein performing wavelet analysis comprises:
 determining the wavelet transform of at least part of the pressure data; and
 defining a wavelet transform threshold.

10 22. The method of claim 21, wherein determining the existence of a blowout precursor comprises determining the existence of a blowout precursor based on a number of instances in a given time segment that the wavelet transform of the pressure data exceeds the wavelet transform threshold.

15 23. The method of claim 21, wherein determining the existence of a blowout precursor comprises determining the existence of a blowout precursor based on a total time in a given time segment that the wavelet transform of the pressure data exceeds the wavelet transform threshold.

20 24. The method of claim 18, wherein performing wavelet analysis comprises:
 determining a wavelet transform of at least part of the pressure data; and
 determining statistical moment data from the wavelet transform of the pressure data.

25 25. The method of claim 24, wherein determining the existence of a blowout precursor comprises determining the existence of a blowout precursor based on a predefined change in magnitude of the statistical moment data.

26. The method of claim 18, wherein performing wavelet analysis comprises:

determining a wavelet transform of at least part of the pressure data;

dividing the statistical moment data into a plurality of time segments;

5 determining statistical moment data from the wavelet transform of the pressure data for each time segment; and

determining the variance of the statistical moment data for each time segment.

10 27. The method of claim 26, wherein determining the existence of a blowout precursor comprises determining the existence of a blowout precursor based on a predefined change in the variance of the statistical moment data.

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